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भाग 2 मीटर मानों का प्रत्यक्ष अंकीय अन्तरण

Indian Standard

TELEMETERING FOR CONSUMPTION AND DEMANDS

PART 2 DIRECT DIGITAL TRANSFER OF METER VALUES

ICS 33.220

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BUREAU OF INDIAN STANDARDS
MANAK BHAVAN, 9 BAHADUR SHAH ZAFAR MARG
NEW DELHI 110002

July 1999 **Price Group 5**

Equipment for Electrical Energy Measurement and Load Control Sectional Committee, ETD 13

FOREWORD

This Indian Standard (Part 2) was adopted by the Bureau of Indian Standards, after the draft finalized by the Equipment for Electrical Energy Measurement and Load Control Sectional Committee had been approved by the Electrotechnical Division Council.

The specification on telemetering for consumption and demand is based on the requirements outlined in Annex A and comprise two parts :

Part 1 — Impulse transmitting and receiving devices. This deals with transfer of incremental meter values by impulsing devices.

Part 2 — Direct digital transfer of meter values. This deals with digital data transfer in which off-line and on-line demand and energy information is transferred through a digital communication channel.

This standard is to be read with IS 13779 : 1993, 'Specification for a.c. static watt-hour meters class 1 and 2'; and IS 13010 : 1990 'a.c. watt-hour meters, class 0.5, 1.0 and 2.0' and CBIP report No. 88 (revision 1996) for a.c. static watt-hour meters, class 0.2S and 0.5S.

For the purpose of deciding whether a particular requirement of this standard is complied with , the final value, observed or calculated, expressing the result of a test or analysis, shall be rounded off in accordance with IS 2 : 1960 'Rules for rounding off numerical values (*revised*)'. The number of significant places retained in the rounded off value should be the same as that of the specified value in this standard.

Indian Standard

TELEMETERING FOR CONSUMPTION AND DEMANDS

PART 2 DIRECT DIGITAL TRANSFER OF METER VALUES

1 SCOPE

1.1 This standard applies to telemetering apparatus intended to operate in conjunction with a.c. static electrical energy meters, in particular for billing and statistical purposes.

1.2 This standard covers telemetering apparatus consisting of :

i) A Master Unit with built in communication interface which receives actual meter values from one or more Slave Units. The information received is either displayed, stored, recorded or mathematically processed (for example in Summation Units) by the Master Unit.

ii) One or more Slave Units which are essentially a.c. static electrical energy meters with built in Communication Interface, which respond to the commands received from the Master Unit by transmitting actual meter values.

1.3 This standard is applicable regardless of the distance between the Master and Slave Units of the telemetering system.

1.4 This standard does not apply to :

i) Telemetering systems transmitting information in an analog form, for example by means of a voltage or current proportional to the measured electrical parameters from the Slave Unit(s).

ii) Telemetering systems employing exclusively impulsing devices.

NOTE — Such systems have been covered by Part 1 of this standard.

iii) Meter Reading Instruments (MRI), which are portable devices used for collection, temporary storage and transfer of data.

1.5 This standard does not cover the channels or media of communication between the Master and Slave Units, such as wired media, telephone lines, radio, optical fibres, microwave, etc; since these channels and media should comply to the appropriate documents /standards.

1.6 Data conversion or modulation devices, if employed, shall be covered by this standard if they form an integral part of the telemetering system.

2 REFERENCES

The Indian Standards listed in Annex B are necessary adjuncts to this standard

3 DEFINITIONS

For the purpose of this standard, the following definitions, in addition to those given in IS 13779 shall apply.

3.1 Supporting Meter

An integrating meter to which it is intended to incorporate a communication device for direct digital transfer of meter values.

3.2 Slave Unit

A supporting meter with communication facility which accepts commands from the master unit and responds by cyclic transfer of meter values as per request.

3.3 Master Unit

A device with capability to communicate and collect the data from the local or remote Slave Unit(s) and process/store the data, if required, in its non-volatile memory.

3.4 Summation Unit

A summation unit is a master unit that sequentially communicates with two or more Slave Meter Units, collects meter values by cyclic transfer, and computes/ store summated meter values and concurrent demand values as required by the system.

3.5 Remote Meter Reading Unit

A remote meter reading unit is a device that communicates with one or more Slave Units and displays and/or stores and/or records the meter information at the remote site on cyclic basis.

3.6 Optical Isolation

The communication port provided in the Master/Slave unit and based on the light pulses emitted/received by photo diode and transistors which have no direct physical contact with internal electrical circuit, there by having a superior method of input/output isolation.

3.7 Meter Values

The measured and registered parameters like current consumption and demand values, billing consumption and demand values like kWh and kW and many other parameters registered in the Slave Unit.

4 SYSTEM CLASSIFICATION

4.1 The Slave Unit shall be classified according to the accuracy class of the supporting meter as defined in the relevant standards.

4.2 The Master Unit shall be classified according to the function performed by it as mentioned below.

4.2.1 *Remote Meter Reading Unit*

A remote meter reading unit should be able to communicate with one or more Slave Units and display and store and record the meter information available in Slave Units at remote sites. The meter reading could be either undertaken on a rapid cyclic basis or on demand depending on the application. Facilities to programme the parameters to be read remotely and the interval of reading should be available in the remote meter reading unit.

4.2.2 *Summation Unit*

A remote meter reading unit that sequentially collects meter values from two or more Slave Meter Units on repetitive basis. It should be able to process the collected data from the Slave Units to calculate summated energy, demand, etc. The parameters to be processed and method of calculation depends on applications and it is a matter of purchase contract. The Master Unit should have programming facility for selecting various parameters depending on the application. The real time of Slave Units shall be in synchronization with the Master Unit.

5 RATINGS

The following standard values shall be applicable.

5.1 Rated Supply Voltage

Standard values for rated supply voltage to Master and Slave Units are :

i) For a.c. : 57.7; 63.5; 100; 110; 230; 240 V; and
ii) For d.c. : 9; 12; 24; 30; 48; 60; 110; 220 V.

5.2 Rated Supply Current

The rated supply current for the Slave Units shall be as per the relevant standard of the supporting meter.

5.3 Rated Supply Frequency

Standard a.c. supply frequency shall be 50 Hz .

5.4 Demand Integration Period

Standard values of demand integration period are : 15; 30 and 60 min.

6 GENERAL AND CONSTRUCTIONAL REQUIREMENT

6.0 The Slave Unit shall conform to the general and constructional requirement laid down by the relevant standard of the supporting meter; the additional requirements for Slave Meters are listed in **6.3** and **6.7**. The Master Unit is not a measuring device and not covered under any standard. Hence the requirements are laid down below.

6.1 General

The telemetering system shall be designed and constructed in such a way so as to avoid introducing any danger in normal use and under normal conditions, so as to ensure especially:

- personal safety against electric shock,
- personal safety against effects of excessive temperature,
- safety against spread of fire, and
- protection against penetration of dust and water.

All parts which are subject to corrosion under normal conditions shall be effectively protected. Any protective coating shall not be liable to damage by ordinary handling, nor damage due to exposure to air, under normal working conditions.

The use of metal enclosures using material subject to corrosion and rusting, shall in general be avoided. However, if the enclosure of any unit is wholly or partially made of metal, it shall be provided with a protective earth terminal.

6.2 Enclosures

The enclosures shall be so constructed and arranged that any non permanent deformation can not prevent the satisfactory operation of the unit.

6.2.1 *Sealing*

Master Units shall have a case which can be sealed in a way that the internal parts are accessible only after breaking the seal(s). The physical communication interface also shall not be removable without breaking the seal(s). This requirement shall also be applicable to Slave Meters forming part of a telemetering system.

6.2.2 *Resistance to Heat and Fire*

The enclosures shall be resistant to heat and fire and shall provide reasonable safety against spread of fire. They should not be ignited by thermic overload of live parts in contact with them. The material used for the enclosure shall conform to method FH1 category 1 of IS 11731 (Part 1).

6.2.3 *Protection Against Penetration of Dust and Water*

The enclosures shall provide adequate protection against penetration of dust and water. The degree of protection shall be IP51 as per IS 12063.

6.3 Display and Display Window

The Slave Units may or may not have a display and a corresponding display window based on the application. This shall be a matter of purchase contract.

The Master Unit shall display the various transferred meter values as well as the processed values if any on an electronic display. All data stored in the memory shall have a minimum retention time of 24 months in the absence of power by means of a non-volatile memory.

In the case of multiple values presented by a single display it must be possible to display the contents of all relevant memories. Provision shall be made for identifying the memory/register being displayed with proper legend.

When the unit is not energised, the display need not be visible.

The registers on display shall be able to record and display starting from zero, for a minimum of 1 500 h all accumulated energy registers corresponding to rated maximum current(s) and reference voltage(s) of the relevant Slave Units.

6.4 Terminal, Terminal Block(s) and Protective Earth Terminal

The Master Unit shall have a suitable termination arrangement to accommodate the connections for its auxiliary power supply and the communication interface. The terminals may be grouped in suitable terminal blocks/strips having adequate insulating properties and mechanical strength. In order to satisfy such requirement, when choosing insulating material for terminal blocks adequate testing of the material shall be taken into account.

The terminal block, the terminal cover (if not of metal), and the case (if not of metal) shall be of a material which complies with the requirement of the method FH1 of IS 11731 (Part 1).

Terminals with different potentials which are grouped close together shall be protected against accidental short circuit. Protection may be obtained by insulating barriers.

The protective earth terminal (if any) :

a) shall be electrically bonded to accessible metal parts,

b) should preferably be located close to the terminal block, and

c) shall be clearly identified by the earth symbol.

After installation, it shall not be possible to loosen the protective earth terminal without the use of a tool.

6.5 Terminal Cover

The terminals of the Master Unit, if grouped in a terminal block and if not protected by any other means, shall have a separate cover which can be sealed independently of the Master Unit main cover. The terminal cover shall enclose the actual terminals, the conductor fixing screws and unless otherwise specified, a suitable length of the external conductors and their insulation.

No access to the terminals shall be possible without breaking the seal(s) of the terminal cover(s).

6.6 Clearance and Creepage Distance

The clearances and creepage distances of the terminal block and those between the terminals and the surrounding parts of the metal enclosure shall not be less than the value specified in Table 1.

Table 1 Clearance and Creepage Distances

Sl No.	Voltage Phase to Earth Derived from Rated System Voltages (Volts)	Minimum Clearances (mm)	Minimum Creepage Distance (mm)
i)	Not exceeding 50	0.8	1.2
ii)	Not exceeding 100	0.8	1.4
iii)	Not exceeding 150	1.5	1.6
iv)	Not exceeding 300	3.0	3.2
v)	Not exceeding 600	3.5	6.3

The clearance between terminal cover, if made of metal, and the upper surface of the screws, when screwed down to the maximum shall be not less than the relevant values given in Table 1.

6.7 Physical Communication Interface

The physical communication interface connections on the master or the Slave Unit shall be made either through screw terminals or on a separate connector. It shall be possible to seal the interface connection either directly or indirectly (by enclosing in a sealable cover), in order to prevent unauthorised connection or disconnection of the interface.

7 MARKING

7.1 The Slave Unit shall be marked as per the relevant standard of the supporting meter.

7.2 The Master Unit shall bear the following information, as applicable :

a) Manufacturers name (or trade-mark) and place of manufacture.

b) Designation of type (if applicable) and if required space for approval mark.
c) The auxiliary supply voltage : Nominal value, type (a.c. or d.c.), number of wires and number of independent supplies (when a PT change-over arrangement is provided). Example of voltage marking is given below :

Type of Supply	*Method of Marking*	*Example*
d.c. Supply	Nominal supply voltage	48 V d.c.
Single phase a.c.	Nominal supply voltage	240 V a.c.
3 phase a.c.	3 × Nominal supply voltage	3 × 110 V a.c.
Single phase multiple feeder	Nominal supply voltage × Number of feeders	110 V a.c. × 3

d) The serial number and year of manufacture.
f) The reference frequency in Hertz.
g) The sign of double square for insulating encased units.
h) The electrical nature of the communication interface, for example RS232 or RS485.

7.3 The marking shall be indelible, distinct and readable from outside the meter.

7.4 The master or the slave units may be marked with the BIS Standard Mark, if certified by BIS.

8 CLIMATIC CONDITIONS

The climatic conditions as laid down in the relevant standards of supporting meter shall be applicable to both Slave and the Master Units.

9 ELECTRICAL REQUIREMENT

9.1 The Slave Unit shall meet all the electrical requirement as laid down by the relevant standard of the supporting meter.

9.2 The following electrical requirement shall apply to the Master Unit.

9.2.1 *Power Consumption*

The total power consumption of the master unit shall not exceed 2W and 10VA, at the reference voltage conditions.

9.2.2 *Voltage Range*

The limit range of operation for the auxiliary supply voltage of the master unit shall be from 70 percent to 115 percent of the nominal voltage.

9.2.3 *Frequency Range*

47.5 Hz to 52.5 Hz.

9.2.4 *Influence of Heating*

Under normal conditions of use the electrical circuits and the insulation shall not reach a temperature which might adversely affect the operation of the Master Unit. The temperature rise at any point on the external surface shall not exceed 20K with an ambient temperature between 25 to 45°C.

9.2.5 *Insulation*

The master unit shall retain adequate dielectric qualities under normal conditions of use, taking account of the atmospheric influences and different voltages to which it is subjected under normal conditions of use.

The master unit shall withstand impulse voltage test and a.c. voltage test as specified in **13.2.3.2**.

10 ELECTROMAGNETIC COMPATIBILITY

10.1 The Slave Unit shall conform to the EMI/EMC requirement as laid down by the relevant standard of the supporting meter.

10.2 The Master Unit shall conform to the following requirements.

10.2.1 *Immunity to Electro Magnetic Disturbance*

The unit shall be designed in such a way that conducted or radiated electromagnetic disturbance as well as electrostatic discharges do not damage or substantially influence the unit.

10.2.2 *Radio Interference Suppression*

The unit shall not generate conducted or radiated noise that will interfere with other equipment.

11 COMMUNICATION REQUIREMENT

11.1 The telemetering system shall be classified according to the type of physical interface to the Slave Units as mentioned below.

11.1.1 *Optically Coupled System*

The physical communication interface shall be optically isolated from the electrical measurement system. Such systems would include Infra red interfaces (including IrDA) and such electrical interfaces that are galvanically isolated from the measurement system by opto-couplers.

11.1.2 *Inductively Coupled System*

The physical communication interface shall be magnetically isolated from the electrical measurement system of the supporting meter.

11.2 Physical Interface

The physical interface of the communication system to the Master or Slave Unit could be coupled electro-magnetically or optically. In either case, the physical interface for the direct digital transfer shall be independent from the interface (if any) for local reading using hand held meter reading instrument.

11.3 Electrical Interface

The electrical circuit of the Slave or Master Unit shall be galvanically isolated from the communication circuit.

11.4 Data Integrity

The data received from the Slave Unit shall not be prone to tampering. If however tampered, the event of the tamper shall be detectable. There shall be no loss of data even when data is retrieved from the Master Unit by external devices such as Meter Reading Instrument.

The slave unit shall not be configurable by unauthorised personnel.

11.5 System Communication Requirements

The Master Unit should be able to communicate with the slave units located remotely or locally on rapid cycle basis or on demand depending on the requirements. The communication speed between master unit and slave unit should be ≥ 1 200 baud depending on the communication channel. In case of direct coupling between Master Unit and Slave Unit(s) the reproduction time of the meter values should not exceed 30 s.

The Master Unit shall be provided with alternative power supply in the event of power failure of one or two Slave Units and communication shall continue with the Slave Units remaining energised.

11.6 Communication Failure Safety

The Master Unit should be able to indicate events of loss of communication with the Slave Unit(s). It should also record last 10 events of such failures and the corresponding occurrence and restoration time/ duration time. The system shall be able to provide energy consumed since communication loss to communication restoration or since communication loss up to the time when user requests the meter value. The system shall be designed such that communication loss gets restored automatically once the cause of communication loss is rectified that is no external stimulus/manual intervention is required to re-synchronize the communication. However, the primary responsibility of restoring the communication shall rest with the Master Unit.

12 ACCURACY REQUIREMENT

12.1 The Slave Unit shall conform to the accuracy requirement laid down by the relevant standard of the supporting meter.

12.2 The Master Unit itself would have no measuring element and hence, its own accuracy is irrelevant. However the data from the slave meter(s) should be reproduced with the same accuracy and resolution. Moreover the uncertainty of the processed (For example Summated) values where applicable should not exceed the error levels of the Slave Unit.

NOTE — Lower accuracy class of Slave Unit will be taken in to consideration.

13 TESTS

13.1 Slave Unit Tests

The Slave Unit shall meet all the test requirement of the relevant standard of the supporting meter.

13.2 Master Unit Tests

All tests shall be carried out under reference conditions unless otherwise stated. The type test shall be carried out on one or more specimens of the unit selected by the manufacturer, to establish the specific characteristics and to prove conformity with the requirement of this standard. In case of modification to the Master Unit after the type test and affecting only part of the meter, it will be sufficient to perform limited tests on the characteristics that may be affected by the modification.

13.2.1 *Type Tests*

13.2.1.1 *Test of mechanical requirement*

13.2.1.1.1 *Shock test*

The test shall be carried out as per IS 9000 (Part 7/Sec 1) : 1979 , under the following conditions:

- Master Unit is non-operating condition, without the packing
- Half-sine pulse
- Peak acceleration 15 g (147 m/s^2)
- Duration of the pulse 18 ms

After the test, the unit shall show no damage or change of the information and shall operate correctly in accordance with the requirements of this standard.

13.2.1.1.2 *Vibration test*

The test shall be carried out as per IS 9000 (Part 8) under the following conditions :
Master Unit in non-operation condition. Without the packing

- Test procedure A
- Frequency range : 10-150-10 Hz.
- Transition frequency : 60 Hz.
- f < 60 Hz constant amplitude of movement 0.15 mm
- f > 60 Hz constant acceleration 2*g* (1*g*= 9.8 m/s^2)
- Single point control
- Number of sweep cycles per axis : 10

NOTE — 10 sweep cycles = 75 min.

After the test the unit shall show no damage or change of the information and shall operate correctly in accordance with the requirements of this standard.

13.2.1.1.3 *Non-flammability*

The terminal block, the terminal cover (if not of metal) and the case (if not of metal) shall be of a material which complies with the requirements of method FH 1 of IS 11731 (Part 1).

NOTE — If the materials of the terminal block, terminal cover and the case meet this requirement, the finished meter need not be tested.

TB terminal cover and case shall conform to the requirements of method FH 1 of IS 11731 (Part 1).

13.2.1.1.4 *Test of protection against penetration of dust and water*

The test shall be carried out according IS 12063 under the following conditions:

a) Protection against penetration of dust
  - Master Unit in non-operating condition and mounted on an artificial wall.
  - The test should be conducted with sample lengths of cable (exposed and sealed) of the types specified by the manufacturer in place.
  - 1st characteristic digit : 5 (IP 5X) resp.
  - Any ingress of dust shall be only in a quantity not impairing the operation of the unit, and not impairing its dielectric strength (insulating strength).

b) Protection against penetration of water
  - Master Unit in non-operating condition.
  - 2nd characteristic digit : 1 (IP X 1) for indoor meters.

Any ingress of water must only be in a quantity not impairing the operation of the unit, and not impairing its dielectric strength (insulating strength).

13.2.2 *Test for Climatic Influences*

After the climatic tests, the Master Unit shall show no damage or change of the information and shall operate correctly.

13.2.2.1 *Damp heat cycle test*

The test shall be carried out according to relevant section of IS 9000 (Part 5/Sec 1) under the following condition:

- Unit in operating condition.
- Voltage and auxiliary circuits energised with reference voltage.
- Without any current in the current circuits.
- Variant 1.
- Upper temperature 450±2°C.
- No special precautions shall be taken regarding the removal of surface moisture.
- Duration of test : 6 cycles.

24 **hours** after the end of this test, the unit shall be submitted to the following tests :

a) An insulation test according to **13.2.3.2**, except that the surge voltage shall be multiplied by a factor of 0.8.
b) A functional test. The unit shall show no damage or change of information and shall operate correctly.

The damp heat test also serves as a corrosion test. The result is judged visually. No trace of corrosion likely to affect the functional properties of the unit shall be apparent.

13.2.3 *Test of Electrical Requirements*

13.2.3.1 *Test of power consumption*

The power consumption in the auxiliary supply circuit of the Master Unit shall be determined at reference values as given in **5.1** by any suitable method. The overall precision shall be better than 5 percent.

13.2.3.2 *Test of insulation properties*

13.2.3.2.1 *General test conditions*

The test shall be carried out only on a complete unit with its cover (except when indicated hereafter) and terminal cover, the terminal screws being screwed down to maximum applicable conductor fitted in the terminals. Test procedure shall be in accordance with IS 2071 (Part 1).

The impulse voltage tests shall be carried out first and the a.c. voltage tests afterwards.

During type tests, the dielectric property tests are considered to be valid only for the terminal arrangement of the unit which has undergone the tests. When the terminal arrangement differ, all the dielectric property tests shall be carried for each arrangement.

For the propose of these tests, the 'earth' has the following meaning :

a) When the unit case is made of metal, the earth is the case itself placed on a flat conducting surface.
b) When the master unit case or only a part of it is made of insulating material, the earth is a conductive foil wrapped around the unit and connected to the flat conducting surface on which the unit base is placed. Where the terminal cover makes it possible, the conductive foil shall approach the conductors within a distance of not more than 2 cm.

During the impulse and the a.c. voltage tests, the circuits which are not under test are connected to the earth as indicated hereafter. A flashover (capacitance discharge) is not necessarily a criterion of failure as this may occurs in a position that does no damage and the manufacturer shall decide. Whether or not to eliminate the cause, provided other criteria of acceptance are met.

After these tests, the master unit shall keep functioning normally and the data in the memory registers shall be maintained.

In this sub-clause, the expression all the terminals means the whole set of the terminals of the circuits and, if any, auxiliary circuits having a reference voltage over 40 V.

These shall be made in normal conditions of use. During the test, the quality of the insulation shall not be impaired by dust or abnormal humidity.

Unless otherwise specified, the normal conditions for insulation test are :

- ambient temperature 200°C to 350°C
- relative humidity 45% to 95%
- atmospheric pressure 86 to 106 kPa (860 mbar to 1 060 mbar)

NOTE — If the ac voltage test is to be repeated for second time, the applied voltage shall be 80 percent of the specified voltage.

13.2.3.2.2 *Impulse voltage test*

The impulse voltage is applied ten times with one polarity and then repeated with the other polarity. The minimum time between the impulses shall be 3 s.

a) *Impulse voltage tests for circuits and between the circuits*
The test shall be made independently on each circuit (or assembly of circuits) which are insulated from the other circuits of the unit in normal use. The terminals of the circuits which are not subjected to impulse voltage shall be connected to earth.
The auxiliary circuits intended to be connected either directly to the mains or to the same voltage transformers as the master units and with a reference voltage over 40 V shall be subjected to the impulse voltage test in the same conditions as those already given for voltage circuits. The other auxiliary circuits shall not be tested.

b) *Impulse voltage test of electric circuits relative to earth*
All the terminals of the electric circuits of the unit, including those of the auxiliary circuits with a reference voltage over 40 V, shall be connected together.

The auxiliary circuits with a reference voltage below or equal to 40 V shall be connected to earth.

The impulse voltage shall be applied between all the electric circuits and earth.

13.2.3.2.3 *ac voltage test*

The ac voltage test shall be carried out in accordance with Table 2 (if repeated second time the voltage wave shall be 80 percent of the specified voltage).

The test voltage shall be substantially sinusoidal, having a frequency between 45 Hz and 65 Hz, and applied for one minute. The power source shall be capable of supplying at least 500 VA.

During the tests relative to earth the auxiliary circuits with reference voltage equal to or below 40 V shall be connected to earth.

Table 2 ac Voltage Tests

Test Voltage (rms) (1)	Points of Application of the Test Voltage (2)
2 kV	(A) Test to be carried out with the case closed, and terminal cover in place (a) Between, on the one hand all the voltage circuits as well as the auxiliary circuits whose reference voltage is over 40 V, connected together, and act on the other hand, earth. (b) Between circuits not intended to be connected together in service
4 kV	(B) Additional tests for insulating encased meters of protective class II (a) Between on the one hand all the (for test a) voltage circuits as well the auxiliary circuits whose reference voltage is over 40 V. Connected together, and, on the other hand, earth

NOTE — The test in item (a) of Part B is to be carried out, with the case closed, the cover and terminal cover in place.

13.2.3.2.4 *Insulation resistance test*

The insulation resistance test shall be carried out in accordance with Table 3 given below. The voltage shall be applied for a minimum of one minute or more for the pointer of the insulation tester to have come practically to rest.

Table 3 Insulation Resistance Test

Test Voltage (rms) (1)	Points of Application of the Test Voltage (2)	Insulation Resistance (3)
500 ± 50 V dc	Between frame and voltage circuits all connected together	5 Megohms

Where two or more voltage circuits are permanently joined together, the combination may be treated as one circuit for this test.

13.2.4 *Test for Electromagnetic Compatibility (EMC Immunity)*

13.2.4.1 *General test conditions*

For all these tests, the master unit shall be in its normal working position with the cover and terminal cover in position. All parts intended to be earthed shall be earthed. After these tests, the master unit shall show no damage and operate correctly.

13.2.4.2 *Test for immunity to electrostatic discharge (ESD)*

The test shall carried out according to IEC 1000-4-2 (1995) 'Electromagnetic compatability (EMC)—Part 4 : Testing and measurement technique—Section 2: Electrostatic discharge immunity test' under the following conditions :

- contact discharge
- test voltage 8 kV
- test severity level : 4
- number of discharges : 10
- voltage and auxiliary circuits energised with reference voltage

The application of the electrostatic discharge shall not produce a change in the registers to more than 0.001 principal units.

13.2.4.3 *Test for immunity to electromagnetic HF fields*

The test shall be carried out according to IEC 1000-4-3 (1995) 'Electromagnetic compatability (EMC)—Part 4: Testing and measurement techniques—Section 3 : Radiated, radio-frequency elcetromagnetic field immunity test' under the following conditions:

- voltage and auxiliary circuits energised with reference voltage,
- frequency band: 80 MHz to 1 000 MHz,
- test field strength : 10 V/m
- test severity level : 3

The application of the HF field shall not produce a change in the register of more than 0.001 per principal unit.

13.2.4.4 *Fast transient burst test*

The test shall be carried out according to IEC 1000-4-4 (1995) 'Electromagnetic compatability (EMC)— Part 4: Testing and measurement techniques—Section 4: Electrical fast transient/burst immunity test' under the following conditions :

- Meter in operating condition
- Voltage and auxiliary circuits energised with reference voltage
- Test voltage : 4 kV
- Test severity level : 4
- Duration of the test : minimum 60 s
- Test points are :
  a) between the terminal of each circuit normally connected to the mains
  b) between any two independent circuits having reference voltages over 40 V
  c) between each independent circuits having reference voltages over 40 V and earth.

During the test the meter shall not produce a change in the register to more than 0.001 principle unit.

13.2.4.5 *Radio interference measurement*

The test for radio interference shall be carried out for the frequencies from 0.15 to 30 MHz and for the frequencies from 30 to 300 MHz as per IS 6842.

13.3 System Level Tests

The system level test of the Telemetering system shall be carried out to ensure proper functioning of the integrated system. This test shall be carried out with the maximum number of slave units for which the system is intended to be tested. The basic objective of the test is to check data communication fidelity.

The slave units are all supplied with the reference voltage and reference current. The initial memory register values of the slaves and master units are noted down prior to commencement of test. The test duration shall be 24 hours. At the end of the test, the supplies to the slave units shall be switched off. The register value changes for all the slave and master unit is recorded after a gap of 30 seconds from the switching off of the supply. The master unit register should show the processed register values as per the slave register values after application of the desired processing function. The error shall not exceed the resolution of the display.

ANNEX A

(*Foreword*)

TELEMETERING SYSTEM

A-1 The Part 1 of this standard based on the IEC 338-1970, is applicable to the conventional telemetering system that utilises activated switching contacts of impulsing devices in conjunction with electromechanical/static meters for transfer of incremental meter values to local/remote electromechanical/static receivers via a transmission channel with or without intermediate summation/ subtraction/integration of such incremental meter values. While such devices are still in use in large numbers, certain limitations of such impulsing devices like electromechanical relays or semiconductors for the sake of transfer of incremental meter values, may be born in mind. Figure 1 illustrates the telemetering system.

A-2 The limitations observed with electromechanical meters with impulsing devices are as given hereunder.

A-2.1 These devices have an inherent uncertainty error as discussed in **5.2.3** of IS 14451 (Part 1). This resolution uncertainty is limited by the maximum response rate that can be achieved by conventional electromechanical relay contacts.

A-2.2 The limited resolution of the impulsing devices lead to measurement inaccuracies, for example in applications involving concurrent kVA demand computation from multiple meters, under varying power factor conditions.

A-2.3 These devices also suffer from contact bounce, improper contacts and distortion problems, leading to data loss and inaccuracies.

A-2.4 Conventional transfer of incremental meter values can only support one parameter information (for example Active import, reactive lag, etc) per meter.

A-3 The new generation of static meters employing improved impulsing techniques with rapid switching contacts of semiconductor devices, have over come some extent, few of the problems mentioned in **A-2** above. They are fast, less uncertain and more dependable. Besides, they can support multiple parameter information per meter. However, they do not reap the full benefit of the static metering technology.

A-4 A number of manufacturers have now come out with more efficient telemetering apparatus employing direct digital transfer of original meter values by utilizing communication interfaces to overcome the inherent limitations of the conventional transfer of incremental meter values by impulsing devices and to provide improved performance with advanced features.

A-4.1 Multiple parameter information can not only be supported by a single supporting meter, but only a single data transfer channel is sufficient.

A-4.2 Effective reliability can be achieved with commensurate accuracy. Single transfer of meter value is direct and original.

A-4.3 This technology can be gainfully used to detect data integrity and take corrective actions in case of temporary loss of data link.

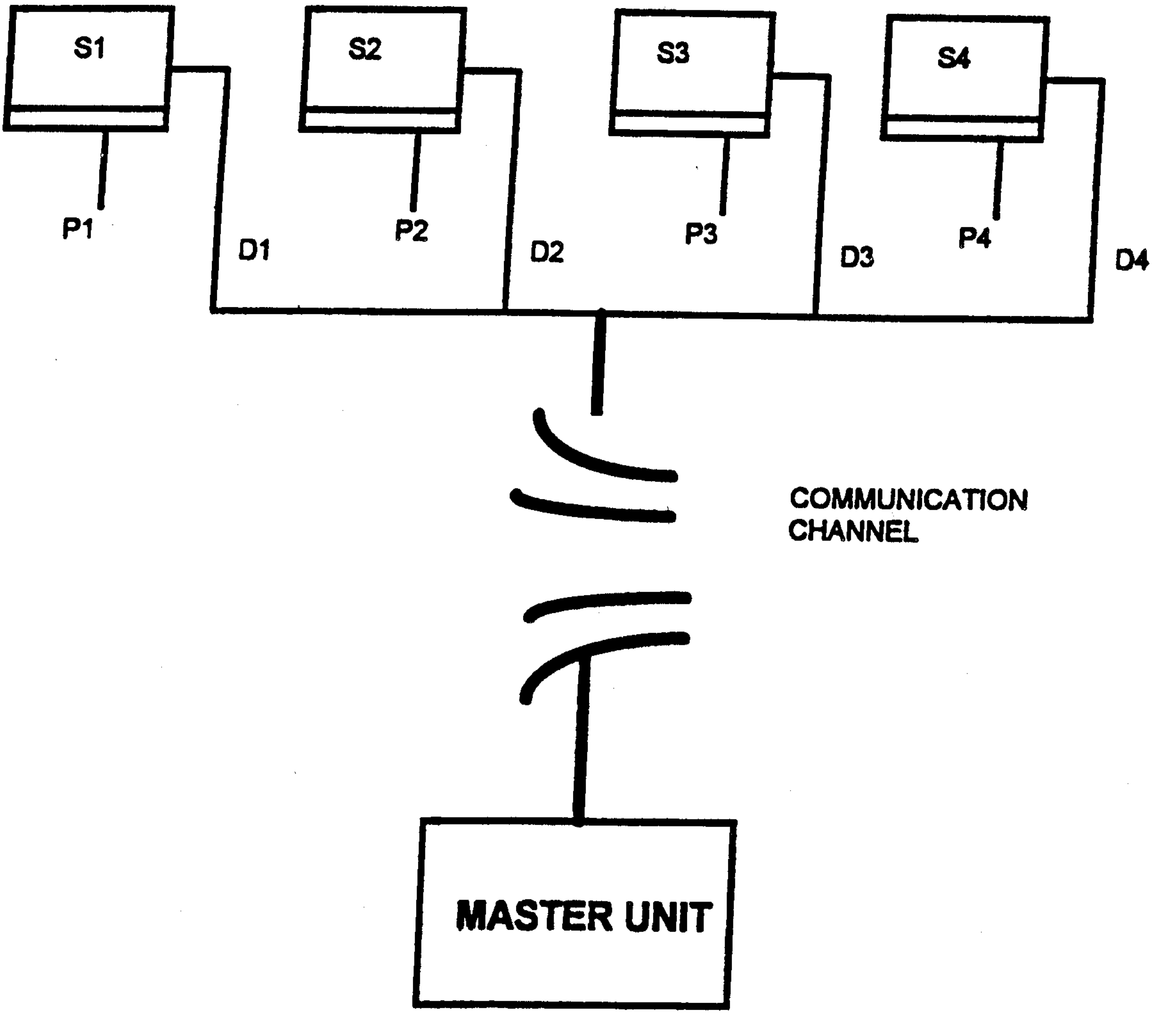
A-5 Telemetering system that utilises static meters for direct digital transfer of original meter values employing communication interfaces, has been dealt with in Part 2 of this standard.

ANNEX B

(*Clause* 2)

LIST OF REFERRED INDIAN STANDARDS

IS No.	*Title*
1401 : 1970	Accessibility test probes (*first revision*)
2071 Part (1) : 1993	High voltage test techniques: Part 1 General definitions and test requirements
4905 : 1968	Methods for random sampling
6842 : 1977	Limits for electromagnetic interference
9000 (Part5/Sec 1) : 1981	Basic environmental testing procedures for electronic and electrical items: Part 5 Damp heat (cyclic) test, Section 1
11731 (Part 1) : 1986	Methods of test for determination of flammability of solid electrical insulating material. When exposed to an igniting source: Part 1 Horizontal specimen method
13010 : 1990	ac Watt-hour meters, class 0.5, 1 and 2
12032 series	Graphical symbol for diagrams in the field of electrotechnology
12346 : 1988	Testing equipment for ac electrical energy meter
12360 : 1988	Voltage bands for electrical installations including preferred voltages and frequency
13779 : 1993	ac Static watt-hour meters class 1 and 2



S1, S2, S3, S4	:	Supporting meters
P1, P2, P3, P4	:	Pulse output devices, this part is covered under Part 1 of this standard
D1, D2, D3, D4	:	Digital communication ports, this part is covered under Part 2 of this standard

FIG. 1 TELEMETERING SYSTEM

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This Indian Standard has been developed from Doc : No. **ETD 13 (5021).**

Amendments Issued Since Publication

Amend No.	Date of Issue	Text Affected

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Printed at : Prabhat Offset Press, New Delhi-2